REMARKS

Claims 1-10 are all the claims pending in the application. Claims 1-9 are rejected as obvious over Arai et al. (U.S. patent 6,401,799), in view of East German patent 266,046, and further in view of Liebermann (U.S. patent 4,676,298). Claim 10 is rejected as obvious over Arai et al., in view of East German patent 266,046, and further in view of Liebermann as applied above, and further in view of Yoshizawa et al. (U.S. patent 5,611,871 or 5,966,064).

Applicants have amended independent claims 1 and 9 to recite the phrase "said amorphous alloy ribbon continuously produced in one casting step having the total length of 3,000 m or more." This amendment finds support in the specification at page 4, lines 9-12, and page 18, lines 5-8.

[1] Rejection of claims 1-9 under 35 U.S.C.§ 103(a) over Arai et al., in view of East German patent 266,046, and further in view of Liebermann et al.

The Examiner rejected claims 1-9 under 35 U.S.C. § 103(a) as obvious over Arai et al., in view of East German patent '046, and further in view of Liebermann et al. Specifically, and with regard to independent claim 1, the Examiner contended the Arai teaches producing an amorphous magnetic ribbon by injecting a melt onto a rotating quench wheel, where the peripheral surface of the quench wheel is subjected to grinding to maintain an appropriate surface roughness. The Examiner further contends the following: (1) that a cooling roll having the claimed average surface roughness (0.5 μm), as is also taught by Arai, would likely also have the claimed ten-point average surface roughness (4.0 μm), (2) that Liebermann teaches the

grinding of a quench wheel during the casting process, and (3) that East German patent '046 teaches that a supply of carbon dioxide to a melt pool reduces the surface roughness of a resulting magnetic strip.

Applicants herein amend independent claims 1 and 9 to recite the phrase "said amorphous alloy ribbon continuously produced in one casting step having the total length of 3,000 m or more." Applicants assert that since the references do not teach, alone or in combination, the production of such an amorphous alloy ribbon, claims 1-9 cannot be obvious. Applicants provide the following explanation.

While it is commonly known that a gas based on CO_2 (a CO_2 gas) can suppress the formation of air pockets in a paddle of an alloy melt during the casting, the present inventors found that new problems arose when an amorphous alloy ribbon exceeding 3,000 m is continuously produced in one casting step. Such problems include a serrated irregular shape development in the edge portions as well as embrittlement and crystallization in the formed amorphous alloy ribbon as the casting time passes. These problems don't occur, even in the long casting process of an amorphous alloy ribbon, unless a CO_2 gas is supplied (see page 3, line 25 to page 4, line 17 of the specification).

Amended claims 1 and 9 recite methods for producing continuously in one casting step, an amorphous alloy ribbon having the total length of 3,000 m or more, whereby the amorphous alloy ribbon has excellent surface conditions and shape in the edge portions, and is stably produced without causing the problems mentioned above (see page 18, lines 5-8 of the specification). The present invention solves the above-mentioned problems by grinding the

cooling roll with a roll-shaped wire brush during the casting. This process keeps an average surface roughness Ra of the cooling roll of 0.3 μm or less, and a ten-point average surface roughness Rz of 2 μm or less, when the surface roughness of the cooling roll is measured according to JIS B 0601 (see page 8, line 17 to page 9, line 15 of the specification).

The present invention was reached after determining that the deterioration of the cooling roll's surface roughness, due to dents caused by incessant impingement of a high-temperature melt, makes a gas highly likely to be entrained into a paddle by rotation of the cooling roll in the presence of a CO_2 gas. The result was embrittlement and crystallization in the ribbon, together with a serrated irregular shape in the edge portions thereof (see page 9, line 22 to page 12, line 11 of the specification).

Applicants assert that none of the references cited by the Examiner suggest the production of an amorphous alloy ribbon continuously produced in one casting step having a total length of 3,000 m or more, such as that recited in the amended claims.

(1) Arai discloses a method of manufacturing a ribbon-shaped magnet material by discharging a molten metal of the magnet material from a nozzle while rotating a cooling roll having a surface layer **53** composed of ceramics on its outer periphery **52** to be collided with said surface of said cooling roll and solidified by cooling (see column 1, lines 58-65 and Fig. 1). However, Arai merely teaches the grinding of the periphery surface prior to the manufacture of the melt spun ribbon in order to obtain an appropriate surfaced roughness Ra of the peripheral surface **53** in a range of 0.03 to 8 μm (see column 8, lines 8-17 and lines 30-33; Ra of 0.5 μm in

Example 1). Since Arai is silent regarding supply of a CO_2 gas during the casting, Arai cannot address phenomenon such as embrittlement and crystallization in the formed amorphous alloy ribbon. In addition, Arai does not suggest a process of producing an amorphous alloy ribbon having the total length of 3,000 m or more continuously produced in one casting step.

(2) East German patent 266,046 (DD'046) discloses a method for producing metal ribbons by rapid solidification of an alloy melt blow ejected from a nozzle onto a cooling roll surface, where a melt puddle formed at an impingement point is sprayed with an inert gas, characterized in that said melt puddle is completely sprayed with carbon dioxide (see claim of DD'046).

Although DD'046 teaches the effect in decreasing the formation of the "lift-off' region by the use of a CO_2 gas (see page 2, lines 13-14), DD'046 is silent regarding new problems that arise when the casting is carried out for a long period of time while supplying a CO_2 gas, and fails to teach or suggest the grinding of the cooling roll during the casting process. In addition, DD'046 does not teach or suggest the production of an amorphous alloy ribbon having the total length of 3,000 m or more continuously produced in one casting step.

(3) Liebermann teaches a process for producing a rapidly solidified continuous metal strip within a low density atmosphere capable of causing a chemical reduction reaction and heating of the quench surface. This low density atmosphere is provided by supplying a reducing gas selected from the group consisting of H_2, CO, CH_4, C_3H_8 and mixture thereof, heated to a temperature of at least 800K. Liebermann also teaches the use of a wiper brush to condition the

quench surface and reduce oxidation thereon (see claims 12-15: column 3, line 21 to column 4, line 14, column 7, lines 25-43 and Fig. 4). Liebermann does not teach or suggest grinding the cooling roll while supplying a CO_2 gas (not a heated reducing gas), near a paddle of the alloy melt ejected onto the cooling roll.

In this regard, it is respectfully submitted that the Examiner mischaracterizes Liebermann in the 2nd full paragraph of page 3 of the Office Action. This paragraph states:

> "Liebermann column 7, line 33 indicates that it was known, at the time of the present invention, to grind the surface of a quench wheel with a brush in processes of making amorphous alloy ribbons. The structure as shown in, e.g., Liebermann figure 4 would clearly be operative while casting is occurring, i.e., the surface of the roll would be treated with the brush (42) of Liebermann as the roll is rotating and while metal is flowing from nozzle (4). Thus, the concept of grinding the roll during the casting process as presently clamed in amended claim 1 would have been considered well-known at the time of the invention."

However, Liebermann describes at column 7, line 33-34, that

> "a wiper brush 42 conditions quench surface 5 to help reduce oxidation thereon,"

and at column 10, lines 33-36, that

> "The combination action of the flame and the conditioning brush reduced the substrate oxidation, increased adhesion and produced ribbon having good geometric uniformity."

This means that a wiper brush of Liebermann is used for conditioning the surface of the cooling roll to reduce the surface oxidation, which proceeds during the casting process, and is not used for grinding the surface of the cooling roll to avoid extreme irregularity such as serration (see page 10, lines 3-13 of the specification).

Therefore, those skilled in the art referring to Liebermann, alone or in combination with Arai et al. and DD'046, would not be motivated to reach the invention recited in amended claims 1-9.

Applicants assert that since none of the references cited by the Examiner, alone or in combination, teach or suggest, the production of an amorphous alloy ribbon continuously produced in one casting step having a total length of 3,000 m or more such as that recited in the amended claims 1-9, claims 1-9 cannot be obvious. Accordingly, Applicants respectfully request that this rejection be withdrawn.

[2] Rejection of claim 10 under 35 U.S.C.§ 103(a) over Arai et al. in view of East German patent 266,046, and Liebermann, and further in view of Yoshizawa et al (U.S. Patent Nos: 5,611,871 or 5,966,064)

Regarding the Examiner's rejection of claim 10, patentability of claim 10 is clear by virtue of at least its dependency on amended claim 1; since neither Yoshizawa patent cited by the Examiner suggests the production of an amorphous alloy ribbon continuously produced in one casting step having the total length of 3,000 m or more. Accordingly, Applicants respectfully request that this rejection be withdrawn.

[3] Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the

Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

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